# Washington State Department of Transportation

# Monument Mapping Engine, v3.2

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The Monument Mapping Engine was initially released on April 12, 2002 and supports WSDOT's ongoing geodetic survey activities. The application was upgraded in 2008 to support the new ArcIMS 9.2 environment. The Mapping Engine uses scale dependent rendering to display a variety of layers as one zooms into a specific monument. The applications initial statewide view shows the location of WSDOT's geodetic survey monuments, National Geodetic Survey's HARN stations, county boundaries, state routes, coastlines, lakes, and major rivers. As one zooms into a scale of 1:75000 or greater, the state highway layer is replaced by a 1999 Tiger Roads layer from the U.S. Census and the DRGs are used as a backdrop. The user may interactively select a monument and request a map or site description for a station Since the Monument Mapping Engine's initial release in 1998 it has received 1000 to 1500 unique visits per month. Based on the cost of installing a monument, the number of site visits, and discussions with members of the professional Land Surveyors' Association of Washington, WSDOT estimates that the State has achieved over $1 million in cost avoidance since the application was fielded.

( http://www.wsdot.wa.gov/monument )

**Washington State Department of Transportation (WSDOT)**
**Monument Mapping Engine, v3.2**

The Monument Mapping Engine was fielded in 1998 as an out of the box ArcView IMS™ application to support WSDOT's survey activities. At the request of the Geodetic Survey Section, Geographic Services Branch, the Office of Information Technology redeveloped the application using ESRI's ArcIMS technology; to include support for Digital Raster Graphics (i.e., USGS 7.5' Topographic maps) and query functions. Development began March 20, 2001 and was completed on April 12, 2002. The application was ported to a new server and to ArcIMS 9.2 in September 2008.

The Mapping Engine uses scale dependent rendering to display a variety of layers as one zooms into a specific monument. The applications initial statewide view shows the location of WSDOT's geodetic survey monuments, National Geodetic Survey's HARN stations, county boundaries, state routes, coastlines, lakes, and major rivers (Figure 1). As one zooms into a scale of 1:75,000 or greater, the state highway layer is replaced by a 1999 Tiger Roads layer from the U.S. Census appear. Background imagery is used within the map service. As one zooms into the map the imagery used changes from a shaded relief image in grayscale, to a color 1:250,000 scale USGS topographic map, and finally to the 1:24,000 scale USGS maps (a.k.a., 7.5 minute topographic quadrangles). These images are used as a backdrop (Figure 2) to provide additional site information for recovering the survey monuments in the field.

**Figure 1. Initial screen received when visiting the Monument Mapping Engine.**

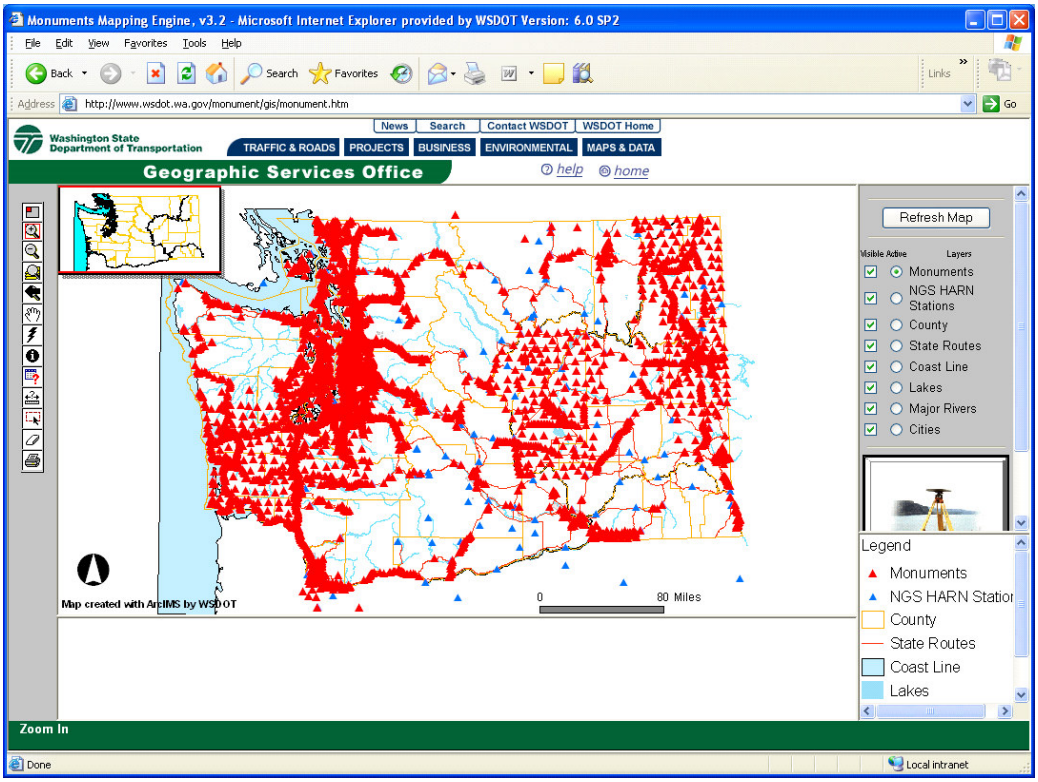
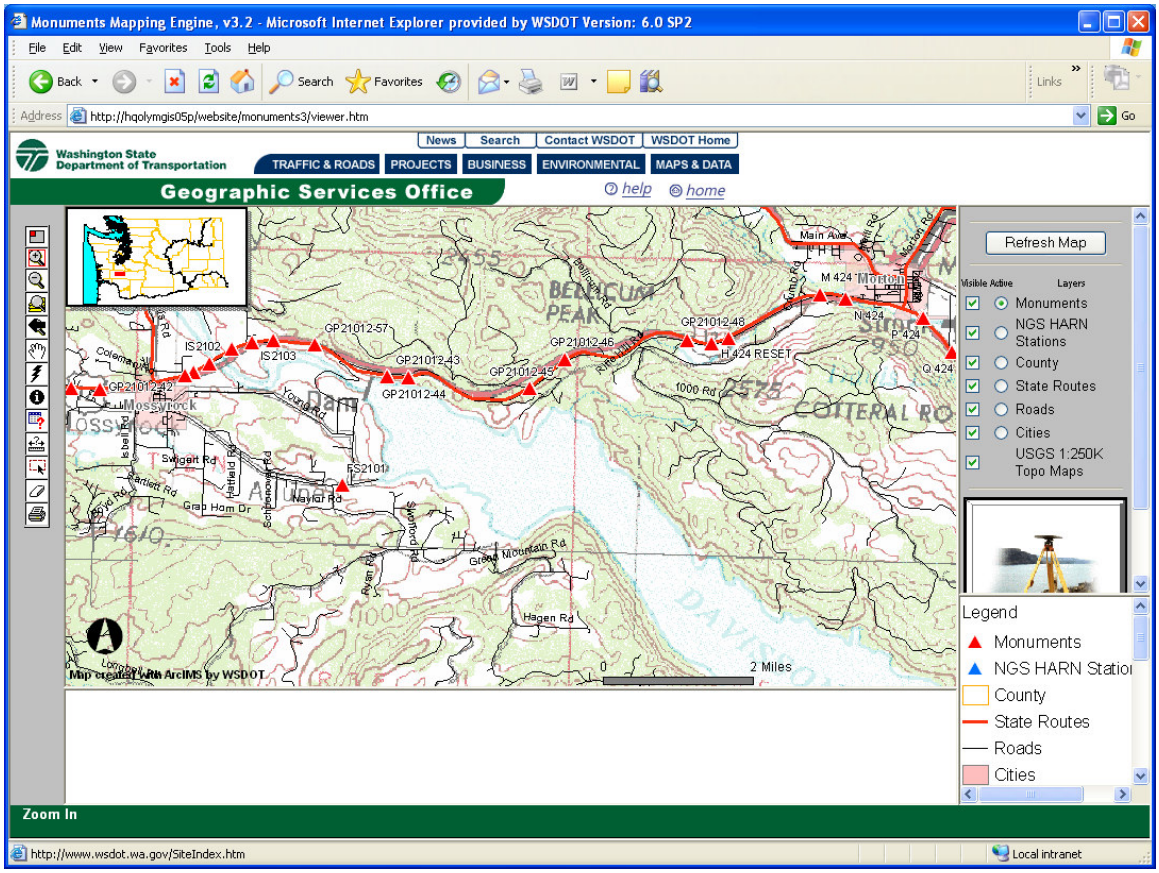


**Figure 2. The backdrop of the display screen changes as the user zooms into the Monument or area of interest.**



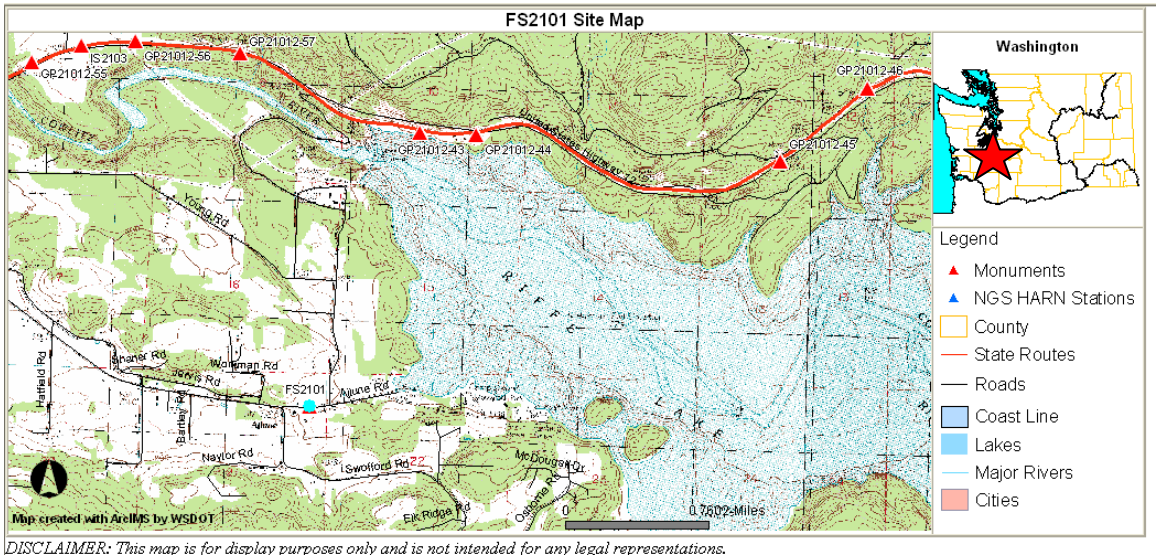

Within the application red triangles indicate the location of survey monuments maintained by the Washington State Department of Transportation, blue triangles show the location of National Geodetic Survey HARN survey stations. Using the tools found on the left side of the application screen (Table 1) the user can zoom into their area of interest then interactively select a monument and request a map (Figure 3) or site description (Figure 4)

**Table 1. Tools available within the Monument Mapping Engine.**

| Symbol | Description |
|---|---|
| | Toggle the display the Overview Map |
| | Holding down the left mouse button, draw a rectangle around a specific area to Zoom in to |
| | Click once on the map to Zoom out |
| | Zoom to the full extent of the map |
| | Zoom to the prevous extent |
| | Holding down the left mouse button, push or pull the map to Pan to the desired location |
| | Click on a feature in the active theme to hyperlink to a web page (see identify) |
| | Select and identify a monument by pointing and clicking |
| | Query the Database to select and zoom to a monument or location by name |
| | Measure the distance along a line between user selected points (values in miles) |
| | Select items in the currently active layer by drawing a rectangle |
| | Clear the currently selected set and redraw the display |
| | Click once to create a Printable map in a new browser |

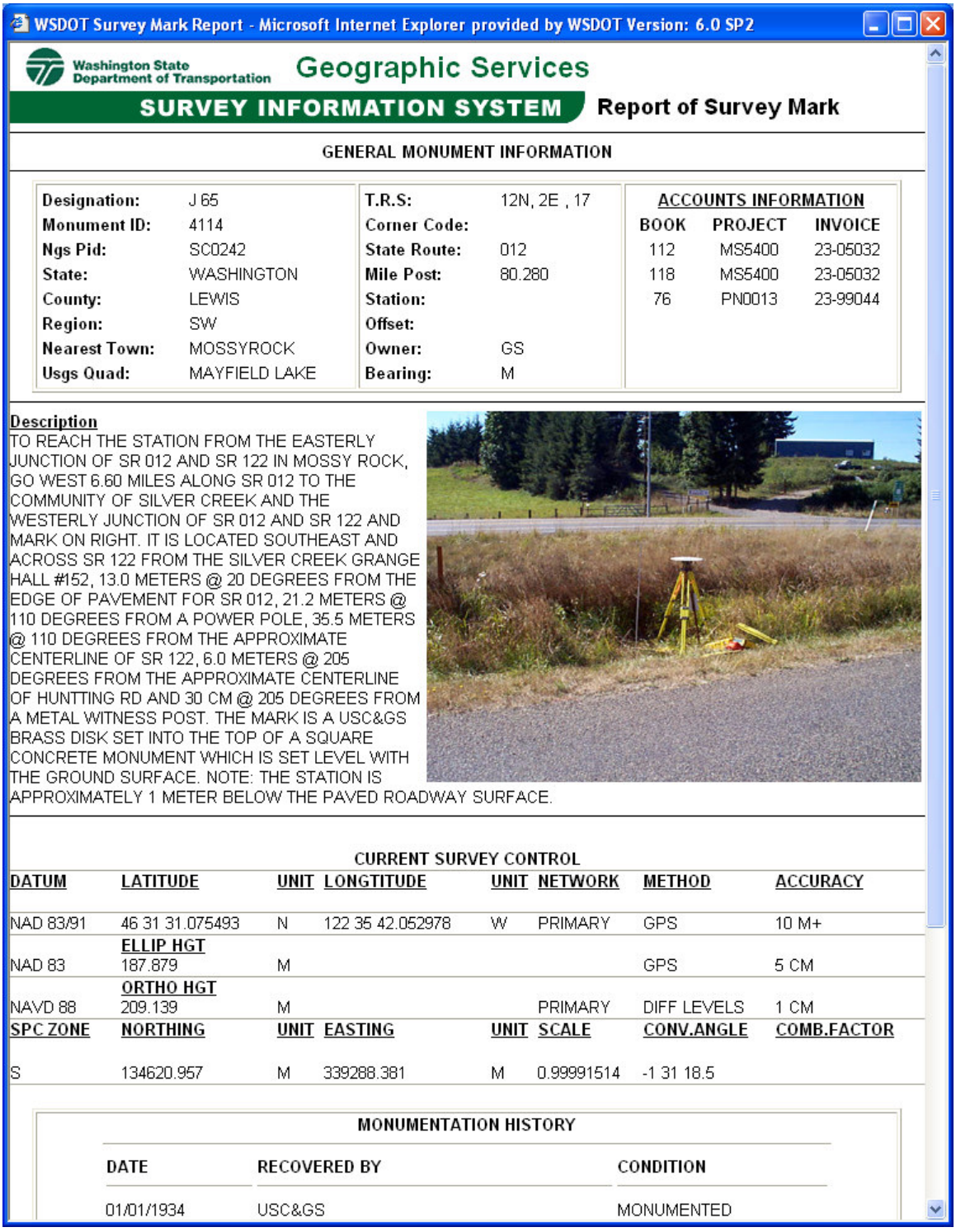
Note that within the application only one data layer may be 'Active' at any one time. By default this is the WSDOT Monuments layer. The identify, hyperlink, and select tools work on the current active layer. To use these tools on a different layer, for example the NGS HARN Stations, you would make that layer 'Active' by clicking on the radio button located to the left of the layers name in the table of contents –which can be found on the right side of the application screen.

**Figure 3. Example of a printable "to reach" map for a survey monument.**




*DISCLAIMER: This map is for display purposes only and is not intended for any legal representations.*

**Figure 4. Example of a monument data sheet obtained using the application.**



WSDOT Survey Mark Report - Microsoft Internet Explorer provided by WSDOT Version: 6.0 SP2

Washington State Department of Transportation — Geographic Services

SURVEY INFORMATION SYSTEM — Report of Survey Mark

GENERAL MONUMENT INFORMATION

| | | | | ACCOUNTS INFORMATION | | |
|---|---|---|---|---|---|---|
| | | | | BOOK | PROJECT | INVOICE |
| Designation: | J 65 | T.R.S: | 12N, 2E , 17 | 112 | MS5400 | 23-05032 |
| Monument ID: | 4114 | Corner Code: | | 118 | MS5400 | 23-05032 |
| Ngs Pid: | SC0242 | State Route: | 012 | 76 | PN0013 | 23-99044 |
| State: | WASHINGTON | Mile Post: | 80.280 | | | |
| County: | LEWIS | Station: | | | | |
| Region: | SW | Offset: | | | | |
| Nearest Town: | MOSSYROCK | Owner: | GS | | | |
| Usgs Quad: | MAYFIELD LAKE | Bearing: | M | | | |

**Description**

TO REACH THE STATION FROM THE EASTERLY JUNCTION OF SR 012 AND SR 122 IN MOSSY ROCK, GO WEST 6.60 MILES ALONG SR 012 TO THE COMMUNITY OF SILVER CREEK AND THE WESTERLY JUNCTION OF SR 012 AND SR 122 AND MARK ON RIGHT. IT IS LOCATED SOUTHEAST AND ACROSS SR 122 FROM THE SILVER CREEK GRANGE HALL #152, 13.0 METERS @ 20 DEGREES FROM THE EDGE OF PAVEMENT FOR SR 012, 21.2 METERS @ 110 DEGREES FROM A POWER POLE, 35.5 METERS @ 110 DEGREES FROM THE APPROXIMATE CENTERLINE OF SR 122, 6.0 METERS @ 205 DEGREES FROM THE APPROXIMATE CENTERLINE OF HUNTTING RD AND 30 CM @ 205 DEGREES FROM A METAL WITNESS POST. THE MARK IS A USC&GS BRASS DISK SET INTO THE TOP OF A SQUARE CONCRETE MONUMENT WHICH IS SET LEVEL WITH THE GROUND SURFACE. NOTE: THE STATION IS APPROXIMATELY 1 METER BELOW THE PAVED ROADWAY SURFACE.

CURRENT SURVEY CONTROL

| DATUM | LATITUDE | UNIT | LONGTITUDE | UNIT | NETWORK | METHOD | ACCURACY |
|---|---|---|---|---|---|---|---|
| NAD 83/91 | 46 31 31.075493 | N | 122 35 42.052978 | W | PRIMARY | GPS | 10 M+ |
| | ELLIP HGT | | | | | | |
| NAD 83 | 187.879 | M | | | | GPS | 5 CM |
| | ORTHO HGT | | | | | | |
| NAVD 88 | 209.139 | M | | | PRIMARY | DIFF LEVELS | 1 CM |
| SPC ZONE | NORTHING | UNIT | EASTING | UNIT | SCALE | CONV.ANGLE | COMB.FACTOR |
| S | 134620.957 | M | 339288.381 | M | 0.99991514 | -1 31 18.5 | |

MONUMENTATION HISTORY

| DATE | RECOVERED BY | CONDITION |
|---|---|---|
| 01/01/1934 | USC&GS | MONUMENTED |

The primary issues tackled during the project were as follows:

- ESRI released ArcIMS 3.1 halfway through the project; this required the HTML and JavaScript code to be revised since ESRI modified their ArcXML definition.
- DRGs were in 2160 TIFF files, each with different pixel sizes. The DRGs were resample and mosaiced into eight images. The images were import into ArcSDE to provide faster display and to allow for Projection-On-The-Fly. This process took four months of processing on a Pentium II computer.
- The production ArcIMS server was purchased in July 2001. The server was not configured till January 2002 due to internal personnel issues.
- The Survey database used by the application was converted from SQL 6.5 to SQL 2000. Application deployment was delayed to allow the change over to be synchronized.

Our current ArcIMS production server is a PowerEdge 1950/Intel(R) Xeon(R) CPU @ 3.00GHz  4GB RAM. The application now uses a ArcGIS Image Service for the main map and an Image Service for the overview map. The maps generated by the image services are delivered to the client as 8-bit PNG color images. The applications HTML and JavaScript pages were initially developed using the ArcIMS Author tool and then customized by WSDOT.

Several benefits have been realized from making the survey information publicly available. Firstly, before the site was implemented WSDOT manually filled monument information[1] requests. Secondly, it has encouraged federal, state, city, and local surveyors to integrate our survey network into their projects. This assists WSDOT in maintaining the network, as construction or maintenance activities are less likely to destroy a station.

Since the Monument Mapping Engine's release it has received 1000 to 1500 unique visits per month. Based on the cost of installing a monument[2], the number of site visits, and discussions with members of the professional Land Surveyors' Association of Washington, WSDOT estimates that the State has achieved over $1 million in cost avoidance since 1998.

[1] After the September 11th terrorist attack, the Monument Mapping Engine was taken off-line for security review. While it was off-line, WSDOT personnel spent ½ to 1 FTE per day responding to phone requests for information.

[2] It costs between $600 and $2000 to install and survey a monument into the geodetic network –depending on the accuracy requirements for the new station.